J. Aust. ent. Soc., 1979, **18**: 233–234

TOXICITY OF INSECTICIDES TO *COCCINELLA REPANDA* THUNBERG (COLEOPTERA: COCCINELLIDAE)

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Abstract

Coccinella repanda larvae and adults were tested by topical application to determine their tolerance levels to nine insecticides. Based on 48 hour LD50 values the ascending order of toxicity to larvae was endosulfan, pirimicarb, thiometon, formothion, chlorpyrifos, demeton-S-methyl, dimethoate, phosphamidon and monocrotophos, and to adults the order was endosulfan, pirimicarb, formothion, chlorpyrifos, thiometon, demeton-S-methyl, phosphamidon, dimethoate and monocrotophos.

The study was conducted as an aid in developing pest management programmes for *Therioaphis trifolii* f. *maculata* and *Acrythosiphon kondoi* in lucerne as *C. repanda* is an important predator of the aphids.

Introduction

The aphids *Therioaphis trifolii* (Monell) f. *maculata* and *Acyrthosiphon kondoi* Shinji, which were first recorded in Australia, in Queensland in 1977 (Passlow 1977 a, b), are major pests of lucerne in most areas of Australia. The development of pest management programmes against the aphids requires information on the effect of insecticides on their predators and parasites. *Coccinella repanda* Thunberg is regarded as an important predator of the aphids (Turner and Franzmann in press). The work reported here was undertaken to determine the contact toxicity of nine insecticides to the larval and adult stages of *C. repanda*.

Materials and methods

C. repanda larvae and adults were collected with a modified D-Vac machine from lucerne fields near Toowoomba, Queensland. Most of the tests were done in September-November 1977, but the tests with demeton-S-methyl, monocrotophos, and phosphamidon on adults were done in October-November 1978.

During and after testing larvae were held individually in small plastic vials and adults were held in groups of five in 90 mm diameter plastic petri dishes at 26 ± 1°C. Adequate supplies of aphids were added to the containers as food. Late instar larvae, but not those nearing pupation, were used in the tests.

A topical application method was used. A one microlitre drop of an acetone solution of technical grade insecticide was applied, using an Arnold Hand Microapplicator, to the dorsal surface of each insect. Ten insects were treated at each of five or six doses and a control (acetone only) per replicate, with three or more replicates. Mortality was recorded after 24 and 48 hours. Both dead and obviously moribund insects were recorded as dead. The results were analysed by the probit method.

Results and discussion

The relative contact toxicities of the insecticides to *C. repanda* are clear from the results given in Tables 1 and 2. Dividing the insecticides into arbitrary toxicity groups

TABLE 1
LD50, FIDUCIAL LIMITS AND SLOPE VALUE OF PROBIT LINE FOR *C. REPANDA* LARVAE

	24 hour				48 hour			
		95% Fiducial limits				95% Fiducial limits		
Insecticide	LD50 ug a.i./insect	lower	upper	Slope value	LD50 ug a.i./insect	lower	upper	Slope value
endosulfan	40	25	123	1.1	8.1	5.8	10	1.8
pirimicarb	3.3	2.5	4.2	2.0	—	—	—	—
thiometon	1.3	0.83	2.1	0.95	0.25	0.10	0.43	1.2
formothion	0.47	0.36	0.66	2.0	0.22	0.15	0.31	1.6
chlorpyrifos	0.13	0.10	0.17	1.9	0.085	0.036	0.15	1.9
demeton-S-methyl	0.079	0.064	0.096	3.5	—	—	—	—
dimethoate	0.10	0.074	0.14	2.0	0.052	0.034	0.082	1.3
phosphamidon	0.030	0.023	0.040	2.1	0.020	0.015	0.026	2.7
monocrotophos	0.018	0.014	0.021	3.9	0.019	0.015	0.023	4.5

TABLE 2
LD50, FIDUCIAL LIMITS AND SLOPE VALUE OF PROBIT LINE FOR *C. REPANDA* ADULTS

Insecticide	24 hour				48 hour			
	LD50 ug a.i./insect	95% Fiducial limits lower	upper	Slope value	LD50 ug a.i./insect	95% Fiducial limits lower	upper	Slope value
endosulfan	75	35	>3000	0.98	34	20	200	1.1
pirimicarb	9.9	7.6	14	1.7	4.6	3.2	6.2	1.5
formothion	0.77	0.56	1.1	1.9	0.39	0.29	0.49	2.6
chlorpyrifos	0.55	0.42	0.70	2.1	0.36	0.24	0.47	2.2
thiometon	0.58	0.46	0.74	1.7	0.24	0.19	0.30	2.2
demeton-S-methyl	0.11	0.087	0.14	4.7	0.098	0.078	0.12	2.6
phosphamidon	0.079	0.067	0.10	3.0	0.076	0.063	0.097	2.8
dimethoate	0.11	0.084	0.14	2.6	0.053	0.017	0.12	2.0
monocrotophos	0.067	0.051	0.10	1.8	0.037	0.030	0.048	2.1

shows that endosulfan, followed by pirimicarb, is the least toxic to both larvae and adults. Thiometon and formothion are moderately toxic to larvae, and these two insecticides and chlorpyrifos are moderately toxic to adults. Chlorpyrifos is very toxic to larvae, and demeton-S-methyl, dimethoate, and phosphamidon are very toxic to both larvae and adults. Monocrotophos is the most toxic insecticide to both stages.

Croft and Brown (1975) reviewed toxicity studies on 15 species of coccinellids (not including *C. repanda*) and arranged the insecticides into five classes of descending toxicity. The results obtained here with five common insecticides (phosphamidon, dimethoate, demeton-S-methyl, thiometon and endosulfan) are consistent with their order of toxicity. Of the others, monocrotophos would appear to fit in class 1, chlorpyrifos and formothion in class 3, and pirimicarb in class 4.

While several of the insecticides (e.g. monocrotophos and phosphamidon) had a rapid effect on *C. repanda*, others (e.g. dimethoate, formothion, thiometon and endosulfan) required a longer time. However, mortality had stablilized within 48 hours for all the insecticides, and so the 48 hour LD50 values are more meaningful than the 24 hour LD50 values. While 48 hour results are not available for demeton-S-methyl and pirimicarb in Table 1 because of non-significant slopes of the probit lines, the data indicated that there was little increase in larval mortality after 48 hours compared to after 24 hours for these insecticides.

The results show that generally the larvae are more susceptible than the adults to insecticides. This is most pronounced with endosulfan, chlorpyrifos and phosphamidon for which the ratio of adult LD50 to larval LD50 is approximately four: one.

This contact toxicity information, along with other factors, has been used in the selection of aphicides for use on lucerne in Queensland. Pirimicarb, thiometon, and demeton-S-methyl currently are recommended when sprays are necessary (Turner and Franzmann in press). The information is also applicable to any other pest-insecticide situations where *C. repanda* is regarded as an important predator. However, it is probable that *C. repanda* would also be affected by insecticides through feeding on poisoned prey, and work to determine the toxicity of insecticides to *C. repanda* by ingestion would be useful.

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[*Manuscript received* 7 *June* 1979. *Revised* 12 *July* 1979.]